The goal of this thesis is to examine the traffic safety impact of upgrading Toll Plazas (TP) to Open Road Tolling (ORT). The ORT could enhance safety but could also pose some traffic safety concerns at Toll Plazas. Crashes from eight years were investigated by evaluating the crash data before and after the implementation of the ORT. The study was conducted by using two approaches: 1) simple before and after study and with a comparison group; 2) modeling effort to help understand the relationship between the crash frequency and several important factors and circumstances such as injury severity, collision types, average daily traffic (ADT) and Toll Plaza characteristics.

The study investigated 11 toll plazas on State Roads 408, 417, 528 and 429, that have been changed to the ORT design. Several maps showing the Toll plazas and identifying the relevant crash locations were generated. The preliminary analysis showed that the total number of crashes was reduced after the ORT implementation. But on the other hand the severity, crash type and location have changed; the majority of crashes occurred at the diverging and merging areas and resulted in more severe crashes.

Negative Binomial (NB), Log Linear model and two-way contingency table were examined. Two log-linear models with three variables in each model with all possible two-way interactions were developed. Categorical data analysis of the 2009 and 2010 crash dataset was performed. In order to compare the differences in response between the crash frequency and a particular crash-related variables; odds ratios were computed. The effects of crash frequency and crash-related factors were examined, and interactions among them were considered. The results indicated significant relationships between the crash frequency and ADT, crash type and driver age.

Implementing ORT, selecting locations of TP, Automatic Vehicle Identification (AVI) subscription rate, traffic demand, and plaza geometry, may have a high influence on traffic safety concerns at toll plazas, as concluded from the Negative Binomial Model's results.

Changing of sign locations, reducing the speed limit, installing variable message signs, proper plaza configuration, and other considerations may be the solution to overcome the potential safety problems in the vicinity of toll plazas.

The change of design to ORT was proven to be an excellent solution to several traffic operation problems including: reducing congestion, improving traffic flow and capacity at toll plazas. However, addressing safety concerns at toll plazas should take the priority.

Major: Civil Engineering

Educational Career:
Bachelor's of Civil Engineering, BS, 2005, AL-Fateh University

Committee in Charge:
Dr. Mohamed Abdel-Aty, Chair, Civil, Environmental and Construction Engineering
Dr. Ahmed Radwan, Civil, Environmental and Construction Engineering
Dr. Nizam Uddin, Department of Statistics

Approved for distribution by Dr. Mohamed Abdel-Aty, Committee Chair, on October 7, 2011.

The public is welcome to attend.